

CHAPTER 12

BETWEEN THE TWO URBANIZATIONS

1. PRELIMINARY REMARKS

In 1963, Leonard Woolley describes the period intervening the two urbanizations in India as follows :¹

The Aryan conquerors were a simple, not to say a barbarous people, pastoral nomads for the most part, some perhaps petty farmers, who had not even a word for 'brick' in their vocabulary ; they could destroy, but they could not rebuild. Just as the Saxon pirates who settled in Britain shunned the Roman sites whose walls of massive stone seemed to their ignorance to be the work of devils, and when in due course began to build did so under the influence not of Rome but of the contemporary architecture of the Continent, so it was with the Aryans. Harappa and Mohenjo-daro were left to moulder into shapeless mounds. True, in the topmost levels are found shoddy huts built with re-used bricks above the ruins of the citadel, but the potsherds prove that such were inhabited not by the invaders but by a remnant of the old servile population who now squatted on the sites where their masters had lived. For more than a millennium after their arrival the history of the Aryans is shrouded in utter darkness ; when at last, late in the fourth century B.C., the veil lifts a little to show us northern India under the Mauryan Dynasty possessed of a great urban civilization, those cities have nothing in common with the old Indus capitals. The burnt-brick-and-bitumen construction which was the most striking feature of Mohenjo-daro architecture is a long-forgotten art ; in the earliest post-Harappa buildings of which we have any knowledge, those at Hastinapura, 80 miles northeast of Delhi, wood is the basic material, and the Mauryan palace at Pataliputra is also of timber. It would seem that when the Aryans began to build for themselves they made a fresh start ; the monuments which they set up were certainly not inspired by any memories of Mohenjo-daro. At Hastinapura and at Pataliputra the remains are not sufficient to show the style of the buildings ; but the earliest buildings in stone are obviously based upon timber originals, and when we look at such a structure as the north gateway of the Great Stupa at Sanchi it is difficult to avoid the feeling that the inspiration comes from the wooden architecture of China.

We have quoted this because we feel that the statement "for more than a millennium after their arrival the history of the

1. L. Woolley in HMCS D VOL. I, Pt. ii, 458

Aryans is shrouded in utter darkness" seems to be in need of some modification, if not from the strictly archaeological viewpoint at least from the standpoint of the history of science and technology in India. It is true that the Vedic people—before being merged into Indian people among which the Aryan and non-Aryan elements are not very clearly distinguishable—left for us nothing spectacular from the strict point of view of material culture. But they created something most amazing in world history—a vast literature of over a thousand songs and hymns which is compiled as the *Rgveda-samhita*. There is no doubt that this has primary interest for the historian of literature. Nevertheless, as we are going to see, even as literature, this contains certain concepts with exceedingly interesting science-potential and even the mythological imagination embodied in it is not without interest specially when compared to the attitude to natural science that eventually developed among the ostensible followers of pure Aryan culture. Secondly, from the technique of retaining this vast literature in an almost incredibly meticulous form and also from the technique of understanding or interpreting its songs and hymns, there did develop certain formal sciences like those of metrics and linguistics, which, if totally ignored, cannot make the history of science in India sufficiently scientific. Considering these, we feel that the thousand years in Indian history after the end of the Harappan culture was not so much shrouded in total darkness as Woolley wants us to believe. Besides, the results of brisk work done by Indian archaeologists on the period intervening the two urbanizations appear to have no place in Woolley's observation, but these are not without interest whatsoever for understanding the achievements of the Vedic people. We begin with a brief account of this archaeological work.

2. RECENT ARCHAEOLOGY AND THE "DARK AGE"

"With the breakdown of the highly developed socio-economic system of the Indus civilization," observe the Allchins, "a major change took place, in that city life seems to have disappeared for several centuries before emerging afresh in the Ganges valley. At the same time a pattern of more or less uniform peasant agricultural settlements appears both inside the Indus region and beyond it. During the second millennium there is plentiful evidence of already developed regional cultures, fre-

quently referred to as 'Chalcolithic' or 'Neolithic-Chalcolithic' in almost every part of the subcontinent".²

Any full review of all this falls outside the scope of our present study. What needs to be noted, however, is that the earlier idea of a total disappearance of the Harappan culture after the destruction or devastation of its major cities—particularly Mohenjo-daro and Harappa—is being increasingly modified by the more recent archaeological work. The need is thus felt to introduce new concepts as Late-Harappan and Post-Harappan culture, in which much of the Harappan traits are said to survive, though as co-mingled with locally developed new traits. Also are found certain sites described as those of overlapping and interlocking of Harappan or Late-Harappan culture with the newly developing local cultures.

The main indices to such sites are certain pottery types, the Black-and-Red Ware, Ochre Coloured Wares, Grey Ware and Painted Grey and Northern Black Polished Ware—the later phase of the last taking us to the fringes of the Second Urbanization. Of these we shall first have a few words on the Painted Grey Ware, because of some special interest attached to these.

3. PAINTED GREY WARE AND THE VEDIC PEOPLE

The sites associated with the Painted Grey Ware (PGW) have received much attention of our archaeologists, because, as A. Ghosh says, 'the geographical horizon of the Later Aryans is conterminous with that' and 'there is also a remarkable chronological proximity between the dates of the beginning of the Ware and the later Vedic age'.³ Readers interested in the details concerning this, may go in for the monograph *The Painted Grey Ware : An Iron Age Culture of Northern India* by Vibha Tripathi (Delhi 1976). For our present purpose, however, it may be sufficient to quote some summary observations on the PGW sites by R. S. Sharma.

Here is Sharma's brief note on the geography of the PGW sites :⁴

2. B & R Allchin RCIP 229

3. A. Ghosh CEHI 6

4. R.S. Sharma MCSFAI 56

The later Vedic texts comprising the collections of the Yajus and Atharvan, the Brahmanas, and the Upanishads were composed in the land of the Kurus and Pancalas. This forms the major portion of western Uttar Pradesh, almost the whole of Haryana, and the neighbouring parts of the Panjab and Rajasthan. In geographical terms this area covers the Indo-Gangetic divide and the upper Gangetic plains. The divide includes the land between the Indus system and the Gangetic system, and covers a large portion of modern Panjab and Rajasthan and the whole of Haryana and the Delhi area. The Indo-Gangetic divide, if the northernmost portion of the Bari doab is included in it, is about 35,000 sq. miles.

At the same time, Sharma wants us to reemember that it would be wrong to connect the sites with the Vedic peoples alone :⁵

Painted Grey Ware sherds have been found in the same areas as are represented by the later Vedic texts. Although the PGW wares have been noticed in eastern UP and even in Bihar, their epicentre seems to be the upper Ganga and Sutlej basins. Nearly 700 PGW sites have been located in this region. They are in much larger numbers when compared with nearly 50 or so ochre coloured pottery sites, and there is no doubt that they indicate agrarian settlements on a large scale for the first time in this area. However there is nothing like an exclusive PGW culture because other wares such as black-and-red ware, black-slipped ware, red ware, and plain grey ware are also associated with them. Although very distinctive, the PGW sherds are not numerically predominant at any place. At Atranjikhara, where the PGW covers an area of about 650 sq.m., its incidence ranges between three and ten percent of the total pottery complex. Even where their number is fairly large, the PGW sherds may not exceed fifteen percent of the total pottery recovered from the PGW layers. Thus the PGW horizon represents a composite culture, just as the culture revealed by the later Vedic texts represents an amalgam of Sanskrit and non-Sanskrit, Aryan and non-Aryan elements.

Roughly speaking, the period covered by these sites is five hundred years—from 1000 B.C. to 500 B.C.

The PGW sites, generally speaking, are not indicative of advanced material culture except towards its end roughly in 500 B.C., which is also the beginning of the period of NBP Ware. Judged by the literary sources like the Upanishads and the Pali Tripitaka, we come across during this period the first foreshadowing of some characteristics of the urban or better proto-

urban life, for the centres of these were still more of the nature of large villages than cities in the full sense.

But there is one point of immense technological significance about the PGW sites. Some of these are indicative of the earliest use of iron in northern India. How and wherefrom the earliest use of iron came into being is still a matter of much controversy. As Vibha Tripathi sums up some of the views :⁶

Wheeler (1959) credited the Achaemenians with the introduction of iron in India in c. 600 B.C. Gordon (1958) thought that iron objects were not used in India prior to 500 B.C. M.N. Banerjee (1929) and Niyogi (1914), however, believed that iron was first brought into India by the Rigvedic Aryans. Forbes (1950) is also of the opinion that iron was known to the earliest Aryan settlers in India. Lallanji Gopal (1961), synthesizing archaeological and literary data, concluded that iron was introduced in the later Vedic period. He emphasized that the Rigvedic term *ayas* could not mean iron. Singh (1965) attached great importance to the pre-PGW level pieces found at Kausambi and on that basis dated iron to c. 1,000 B.C. But the late and degenerate nature of PGW at Kausambi (even the existence of a PGW deposit at the site has been questioned by Sinha) does not warrant the high antiquity claimed for iron at Kausambi. N.R. Banerjee (1964) believes that iron technology was introduced in India in c. 1000 B.C. by the Aryans. Tandon (1967-68) suggests that a chemical, technical and typological study of iron implements is required for understanding the multi-disciplinary problems posed by the Iron Age.

These controversies do not allow any agreed dating and authorship of early iron. Meanwhile, further field work has produced evidence of a new kind.

Let us not, however, be involved here in such controversies. What interest us most in our study of the history of technology and science are the results reached so far by the field-work of our recent scholars. Here is how R. S. Sharma sums these up : 'In any case', he observes, 'the PGW phase marked by the use of iron in the Upper Gangetic plains and Indo-Gangetic divide can be reasonably dated to c. 1000-500 B.C.' At the same time it needs to be noted that the use of iron in the earlier of these sites was extremely restricted. These 'mainly comprise spearheads, arrowheads, hooks, etc.'⁸ This means that it would

6. Vibha Tripathi in RCIA 272

7. R.S. Sharma MCSFAI 58

8. *Ibid* 59

be fallacious to equate the PGW period with that of the introduction of iron technology in full sense. Apart from the fact that the limited use of iron artifacts are also found in certain other sites⁹, one point needs to be specially noted: 'Broadly speaking iron technology made little impact on the economy of the PGW period. Mud or mud-brick houses with reed thatching, limited number of antiquities indicating restricted trade and commerce and absence of heavy agricultural implements during the PGW phase represent a typical picture of a village economy. 'The economy was simple. No doubt, in a slow-moving society the impact of iron was slow. The metal did not produce any spurt in the material prosperity of the society'.¹⁰ To this may be added the further observations of R. S. Sharma :¹¹

Therefore till the sixth century B.C. northern India did not enter into a full-fledged iron age. Only in the second phase of iron associated with the NBP levels (500-200 B.C.) do we encounter more agricultural implements. This picture is consistent with the history of iron technology in Western Asia and elsewhere. In the first stage it was used for purposes of war, and in the second for handicrafts and agriculture. In the first phase in India, the use of iron could not be extended to production because of its paucity and primitive technology, but it may have helped the organizers of production in making their authority felt over the producers. However in this phase iron may have been used for clearance, for making wheels and the body of carts and chariots, and in the construction of houses because nails have been recovered from several PGW sites.

At the same time the iron-finds in the PGW sites associated with the Vedic peoples—in the kingdom of Kurus, of Pancalas, of the Matsyas, of the Madras,—and specially the fact that the 'largest deposit of iron weapons discovered so far belongs to Atranjikhhera in the Pancala area'¹² are in no way to be overlooked. These evidences want us to think that the Vedic peoples knew iron, though without knowing more than its limited use for war purposes. One obvious reason for this must have been the relative scarcity of the metal: far-reaching conse-

9. Vibha Tripathi PGWIACNI 100ff.

10. *Ibid* 102. The quotation is from A. Ghosh CEHI, 10

11. R.S. Sharma MCSFAI 72

12. *Ibid*

quences of the use of iron technology were possible only when iron was found in abundance and hence became a "cheap" metal in the rich iron ore deposits in the eastern zone, which also became the main centres of second urbanization in Northern India. But the other important reason for the restricted use of iron by the early Vedic peoples before they got mixed up with the local peoples or "merged into Indian people" could have been their socio-economic organization : being nomadic pastoral people after all, they could hardly realise the importance of iron beyond the limited purpose of weaponry. However, before passing on to discuss the more spectacular results of the introduction of iron technology in an extensive scale in the comparatively later period, we may be permitted to digress a little and see if we can find anything deserving special notice from the viewpoint of the history of science as distinctive contributions of the early Vedic peoples.

4. THE RGVEDA-SAMHITA AND SCIENCE IN INDIA

If we have so far discussed mainly the destructive activity of the early Vedic people, we may as well note here some of their creative activities and see if there is something in these that interests us specially from the viewpoint of science in India.

By far the most outstanding creative activity of the early Vedic peoples is the *Rgveda-samhita* which comes down to us as a vast collection of 1028 songs and hymns in a total number of 10,552 verses or *rk-s*. Strangely, however, the makers of this vast literature were pre-literate people—or people without any knowledge of script—though the literature survive for us in its meticulous form by being transmitted through generations of sheer retentive memory ; it is thus called *sruti* or 'that which is heard'. Prompted apparently by chauvinistic enthusiasm, S. R. Rao has recently argued practically against the entire world of serious Vedic scholarship and observes : 'But the mere absence of written records during the Vedic period does not imply that writing was unknown to the Vedic Aryans. The Rigvedic Aryans might have used a perishable material for writing, as the Late Harappans did.'¹³ No evidence of the Late

Harappans using perishable materials for writing purposes is given by Rao. But the more important point is that the postulate of using perishable materials for writing is relevant only in case of the peoples who are otherwise definitely known to have the knowledge of the script. However, the ancient Vedic poets themselves would perhaps testify against such a possibility, inasmuch as they speak of "making songs by the mouth", or, in simpler language, what we call oral composition. Thus the poet Kanva, son of Ghora, addressed the Maruts :

'Make hymns by your mouth (*asye*) ; spread these like the cloud ; sing the *ukthya* (laudatory hymn) in Gayatri metre.' (RV 1.38.14).

Incidentally, Sayana interprets *asye* as *svakiya-mukhe* or in one's own mouth, and thus leaves no scope for using any writing material—perishable or otherwise.

To this may be easily added certain other internal evidences of the Vedic tradition. In the *Nirukta*, Yaska uses the word *upadesena* (i. 20), which is understood straightway by Lakshman Sarup¹⁴ as "oral tradition". Why does he do it ? The word *upadesa* is derived from the root *dis* meaning "to utter". *Upadesena* thus literally means "well uttered", easily brushing aside the possibility of recording in writing on any perishable material. Besides, the word usually rendered as "revelation" in the Vedic context is *amnaya*, as it is done for example in the *Vaisesika-sutra* (1.1.3). The word *amnaya*, derived as it is from the root *mna*, indicates oral communication : *mna kathane*. Here, again, the distinct implication is "to utter" or "to speak".

Thus Rao's idea of the Vedas having been once written on perishable material, goes against the Vedic tradition itself. But why does an archaeologist of his stature go in for such an extraordinary hypothesis ? Evidently, because he wants to revive and revitalise Ramachandran's thesis that the Vedic Aryans were the actual makers of the Indus civilization, one of the most formidable evidences against which is that these Aryans were pre-literate peoples. It may not, therefore, be irrelevant here to show how strong is the verdict of orthodox Vedic tradition itself against Ramachandran's view. One of the arguments of Ramachandran, as Rao says, is 'that the Indus seals depict

Vedic cult scenes'.¹⁵ Ramachandran says, 'the Rgvedic idea that the bull does all the roaring to proclaim *dharma-vijaya* is caught up by the Mohenjo-daro seals and sealings representing the bull with its characteristic dewlap'.¹⁶ As evidence of the bull "proclaiming *dharma-vijaya*" in the *Rgveda*, Ramachandran quotes the following from the *Rgveda* : "*tridha baddho vrsabho roraviti mahodevo martyanavivesa*", which Ramachandran translates : "The thrice-bent bull goes on roaring that the Great God (is no longer in some invisible heavens but) has actually completely entered the mortals."¹⁷ The Rgvedic passage is all right (iv. 58.3), so also is the occurrence of the word *vsabhu* in it, as it also occurs in *Rgveda* iii. 55.17 ; vi. 73.1 ; vii. 101.1 etc. Only the "bull" is not there in these passages. Beginning from the *Mahabhasya* of Patanjali¹⁸ c. 150 B.C. and *Nirukta* Yaska¹⁹ c. 500 B.C. to Sayana²⁰ c. A.D. 1400, the word *vsabha* in this context is derived from the root *vs*, literally "to shower" and in the *Rgveda* it means "showering bounties."

So the bulls in the Harappan seals can be taken as evidences of the Aryan origin of the Harappan civilization only by flouting the authority of Patanjali, Yaska and Sayana who refuse to interpret the word *vsabha* as the bull. Of course, any suggestion of *dharma-vijaya* is not there in the *Rgveda* ; it exists only in the imagination of Ramachandran and Rao. Besides as A. Ghosh points out that it is statistically impermissible to deduce the characteristic peculiarity of the Harappan civilization mainly from the evidence of the bulls in the Harappan seals. As he puts it, "The Unicorn which has no place in later Indian religious belief, heads the list [in the Harappan seals] with a frequency of 1,159 while the bull, in all its forms, is a poor second, with only 156."²¹

15. S.R. Rao LIC 137

16. T.N. Ramchandran *Presidential Address, Ancient India, Section 1.* quoted by Rao LIC 137

17. See S.R. Rao LIC 138

18. *Mahabhasya* Paspasa-ahnika

19. *Nirukta* Parisista xiii. 7

20. Sayana on iv.58.3 renders *vsabha* as *phalanam varsita*, i.e. showering results (bounties). Interpreting x.8.2 also he takes the word to mean *kamanam varsita* i.e. showering what is desired

21. A. Ghosh in Possehl HC 321.

However the strongest evidence against the possible Aryan origin of the Harappan civilization is the socio-economic conditions of the early Aryans, who were nomadic pastoral peoples after all, still on the tribal stage of social development, and hence did not possess the tools or equipments to build up the highly developed urban civilization like the Harappan one.

Yet, as we are going to see, they had something significant to contribute to the history of science in India.

5. PREDOMINANTLY PASTORAL ECONOMY

The *Nighantu*—the earliest of the glossaries of Rgvedic words, which Winternitz is inclined to place sometime before 700 B.C.²² mentions the word *go* or cow as one of the synonyms of *prthivi* or the earth (*Nigh.* i. 1). This justified Sayana to interpret the word *go*, as occurring in one of the comparatively later *rk*-s of the *Rgveda* (x. 31.10) as the earth. According to the *Nighantu*, again, the word *aditi* is the synonym of *go* as well as *prthivi* (ii. 11 and i. 1). Similarly, the word *ila*, besides being a synonym for *anna* or food, also stood for *go* and speech or *vac* (i. 1 ; i. 11 ; ii. 7 and ii. 11).

Such ambiguities tell their own story : the cow meant practically everything that the Vedic 'seers' or poets cared for—speech, food and in fact the whole world. The main theme of their hymns or songs was, of course, the praise of their gods. However, one of the seers went to the extent of singing the glory of the god because of being born of the cow (*gojata*) (vi. 50. 11). Even the *Pancavimsa Brahmana*—much later than the *Rgveda*—wanted to measure the distance between the heaven and earth by imagining a thousand cows placed on top of each other (xvi. 8.1 and xxi. 19). To all these R. S. Sharma adds : "Cattle were considered to be synonymous with wealth (*rayi*), and a wealthy person was called *gomat*. Terms for battle such as *gavisti*, *gosu*, *gavyat*, *gavyu* and *gavesana* were derived from cattle, which was the measure of distance (*gavyuti*) and also of wealth and wergeld. *Gopa* or *gopati* was the epithet given to the king. In the life of the family the importance of cow is indicated by the use of the term *duhitr*, one who milks, for daughter. Gods were divided into four categories, heavenly

(*divya*), earthly (*parthiva*), cow-born (*gojata*) and watery (*apya*)."²³

Further evidences are perhaps unnecessary. The poets or seers whose compositions come down to us as compiled in the *Rgveda-samhita* were predominantly pastoral peoples. As for agricultural practices of the Rgvedic peoples R. S. Sharma gives us very interesting philological evidences. His starting point is the following argument :²⁴

Terms for possessions found in the *Rg Veda* and having parallels in other Indo-European languages may throw light on the nature of property in the earliest Vedic society. Their number however is limited, and hence negative evidence becomes more important. It may be argued that terms for certain economic activities existed in pieces of Vedic literature which are not available, and that such terms should not be looked for in 'religious' literature. But the vocabulary of the *Rg Veda* is rich, and the main concern of the prayers is the material prosperity of the Aryans. Therefore the absence of words for some economic phenomena in the *Rg Veda* may be considered significant, especially when they are not found in other old allied languages. On the other hand we have also to take account of such terms as are found in Sanskrit and all other Indo-European languages and assign them to the earliest period of Vedic society, although all of them may not appear in the *Rg Veda*.

With this argument, he reviews the words related to agriculture and agricultural operations in the Vedic literature :²⁵

It is significant that no common terms or cognates for cereals and cultivated plants are to be found in Indo-European languages, which indicates that cultivation made progress only when the Aryans settled in different countries. If we examine the various Indo-European terms for agriculture and vegetation listed in Chapter 8 of the *Dictionary* of Buck, it would appear that most Sanskrit terms for plough, furrow, cultivation, dig, spade, sickle, cereals, etc., do not have their cognates in Indo-European languages, although a few are found in Avestan. Although the term *ar* in the sense of plough is found in Indo-European languages, yet it has no linguistic parallel in Sanskrit. Linguistically this term cannot be reduced to *hala* (plough). All this would suggest that the Indo-Aryans took to agriculture in India, and to express this activity they adopted some local words.

23. R.S. Sharma MCSFAI 24

24. *Ibid* 22

25. *Ibid* 26

To these, it is tempting to add another point already mentioned by R. S. Sharma :²⁶

In ancient Indo-European languages there is no term corresponding to *krsti* in the sense of cultivator....Curiously enough Sayana understands *krstih* in the sense of *prajah* or people, though hostile. Hence the common notion that *krsti* may indicate cultivation in the Indo-European context has to be discarded. Similarly the use of the term *carsani* in the *Rg Veda* and the modern derivation *casa* (cultivator) in Bengali and *cas* (ploughing) in Maithili do not seem to indicate the original meaning of the Vedic term. It is suggested that the term is derived from *krs*, 'to plough' or 'to till'. But it is correctly thought that the term is derived from *car*, 'to move', and therefore the five *carsanayah* were five moving peoples who could be compared to the *pancajanah*.... The well-known term *hala* does not appear, but two other terms for plough, *langala* and *sira* occur in the earliest books; the *varatra* or a leather strap of the plough is also mentioned. We hear of *phala* or ploughshare and furrows (*sita* and *sunu*) in Book IV, where a hymn is devoted to agricultural operation. However it has been argued by Hopkins that Book IV is the latest Family Book, and is as late as Book VIII.

6. RTA : THE PRIMORDIAL COMPLEX OF NATURAL LAW AND MORAL LAW

To sum up the discussion so far : The early Vedic peoples, specially judged by the older strata of the *Rgveda-somhita*, were predominantly pastoral tribes who eventually acquired some knowledge of agriculture perhaps from local peoples among whom they advanced and with whom they got increasingly mixed up, losing thereby their original racial identity. We are now going to see that for the key to their intellectual attitude it is desirable to begin with what is known in general about tribal peoples from unbiased ethnological studies. I have elsewhere²⁷ attempted to go into some detail of this question about the early Vedic people, highlighting the relics of the sense of tribal collectivity retained in the *Rgveda* : in innumerable passages of the *Rgveda* property is viewed as collectively owned by the kinsmen and shared out among them, significant decisions being taken by them in their tribal assemblies and individuality is recognised mainly in terms of special merit in war, crafts-

26. *Ibid* 25

27. D. Chattopadhyaya *Lokayata* Ch. 8

manship, healing technique, etc. These songs and hymns thus take us back to a general intellectual climate very different from that of ours.

In that intellectual climate we come across a concept with an exceedingly interesting science-potential. It seems to represent an instinctive awareness, as it were, of a primordial complex of natural order and social order—of natural law which is at the same time moral and social law—inviolable and obligatory even for the Vedic gods, who are at best sometimes conceived as its custodians but not its makers. Understandably, in the rather archaic songs of the *Rgveda* we do not expect the concept of the law of nature in a chiselled form. On the contrary, we come across it as largely mixed up with the mythological imagination of the Vedic poets. Nevertheless the possibility was not fulfilled. Rooted as it was in the instinctive morality of the collective life, its sense was lost to the later Vedic poets with their move forward to a social order based on class differentiation and early state power which, whatever might have been its exact nature, was dominated presumably by war-chiefs.

But let us first have some idea of the concept of *rta* in early Vedic consciousness.

The Angirasas whose spells and charms, along with those of the Atharvans, formed the original core of the *Atharvaveda*, were remembered also by the earliest stratum of the *Rgveda* as but hoary ancestors—'the fathers', 'our fathers', 'those ancient poets', etc. They were also said to have lived the ancient collective life and were hence free from jealousy in any form. All this, however, followed from their observance of the *rta* :

"Those ancient poets, the observers of the *rta*, were in joyful company of the gods ; these ancestors gained the secret lustre : with spells of truth they generated Usas. Being united with the common cattle, they became of one mind : they strive together, as it were, nor do they injure the rituals of the gods ; not injuring each other, they move with wealth." (RV vii. 76.4-5).

Such then was influence of *rta*, which, along with its derivatives and compounds, occur over 450 times in the *Rgveda*. It has naturally to be viewed as one of the key concepts of this vast collection of songs and hymns. It is also so archaic in content that it is not easy to suggest any fully satisfactory modern equivalent for it, and even the traditional commentator Sayana fails to explain it uniformly throughout the *Rgveda*.

Modern scholars have nevertheless attempted to translate it and they appear on the whole agreed to see in it some kind of a peculiar complex of natural as well as social law, or of the cosmic order which is at the same time the social order.

Winternitz used it in the sense of the "order of the universe."²⁸ Macdonell took it to mean the "physical and moral order",²⁹ though adding, "the notion of this general law, recognised under the name *rta* (properly the 'course' of things) we find in the *Rgveda* extended first to the fixed rules of the sacrifice (= rite), and then to those of morality (right)".³⁰ According to Keith, it was the term for the cosmic order as well as moral order: "The term cosmic order, *rta*, and its opposite *anrta*, express also moral order".³¹

As for the Vedic poets themselves, they wanted to raise this principle to the most exalted position. Thus :³²

The dawns arise in the morning according to the *rta*; the fathers have placed the sun in the heaven according to the *rta*; the sun is the bright countenance of the *rta*, and the darkness of the eclipse is contrary to law, *vrata*. The year is the wheel of the *rta* with twelve spokes. The red raw milk, the product of the white uncooked cow, is the *rta* of the cow under the guidance of the *rta*. Agni, the fire, which hidden in the waters and the plants, is produced for man from out of the kindling sticks, becomes the shoot of the *rta*, born in the *rta*. The streams flow in obedience to the law of *rta*.

Radhakrishnan, apparently obsessed with the zeal to read his own idealistic outlook in the *Rgveda*, tries to give an idealistic twist to the concept of the *rta*. As he puts it,³³

....*Rta* literally means 'the course of things'. It stands for law in general and the immanence of justice. This conception must have originally been suggested by the regularity of the movements of sun, moon and stars, the alternations of day and night, and of the seasons. *Rta* denotes the order of the world. Everything that is ordered in the universe has *rta* for its principles. It corresponds to the universals of Plato. The world of experience is a shadow or reflection of the *rta*, the permanent reality which remains unchanged

28. M. Winternitz HIL I. 154

29. Macdonell HSL 75

30. *Ibid* 67

31. A.B. Keith RPVU 248

32. *Ibid* 83

33. S. Radhakrishnan IP I. 78-9

in all the welter of mutation. The universal is prior to the particular, and so the Vedic seer thinks that *ṛta* exists before the manifestation of all phenomena. The shifting series of the world are the varying expressions of the constant *ṛta*, so *ṛta* is called the father of all.

The comparison of the Rgvedic *ṛta* to Platonic Ideas of which the worldly things are but shadows would have appeared frankly so incomprehensible to the Vedic poets themselves that it perhaps does not need any comment. Throughout the vast collection of primitive poetry, if we are at all justified in reading any central theme, it is the intense desire for this-worldly wealth, i.e. as far as the pastoral peoples are capable of thinking or imagining. On the contrary, the comparison of the Vedic *ṛta* is perhaps valid with certain other concepts of the ancient period. These are the concepts of *asa* in the Avesta and the *tao* of the Chinese Taoist. Keith observes :³⁴

In the physical world there rules a regular order, *ṛta*, which is observed repeatedly, and which is clearly an inheritance from the Indo-Iranian period, since the term *asa* (*urta*) is found in the Avesta, and has there the same triple sense as in Vedic India, the physical order of the universe, the due order of the sacrifice, and the moral law in the world.... The identity of the Vedic and Avestan expressions is proved beyond possibility of doubt by the expression 'spring of *ṛta*', which is verbally identical in *Avesta* and the *Rgveda*.

More interesting, perhaps, is the comparison of the Rgvedic *ṛta* to the *tao* of the Chinese Taoists, to which Cornford has drawn our attention.³⁵ But we shall return to *tao* and *ṛta* later.

Filliozat is inclined to see in the *ṛta* "the rudiment of the scientific notion" and observes :³⁶

The *ṛta* is the regular order in general, being the moral rectitude, the ritual exactitude and the true law of the universe ; in one word, it is the 'Norm'. Varuna is the Lord and the guardian of this 'Norm'. The concept of *ṛta* goes back to the Indo-Iranian period ; to the Vedic *ṛta* correspond exactly the Avestan *asa* and the Old-Persian *ṛta*. He has for basis the sentiment that all things are harmoniously regulated and are not left to chance in this universe.

34. A.B. Keith RPVU 83

35. F.M. Cornford FRP 172ff

36. J. Filliozat CDIM 91-92

The fixity of the stellar figures, the periodical return of the mobile stars to similar positions, the evident verification of all the principal and regular phenomena of nature have, from a very early date, imposed this notion. Among the peoples inclined to explain the organism by the cosmos and the cosmos by the organism, this notion must have quickly extended itself from the sky to the earth, from the world to the living being. Although victim of innumerable accidents, the existence of this last one could not be conceived as being outside the orbit of the great cosmic law, as the same body was a little cosmos. If this is not, properly speaking, a scientific concept of natural law, it is at least an idea quite near the same. The scope of this idea is absolutely general because there is nothing which is not governed by *ṛta*, including the moral behaviour of man. Sometimes the Indian and the Iranian minds are blamed for having thus mixed up the physical and the moral but it should also be recognised that this very mind has also raised above them a sufficiently large concept for covering both of them.

An interesting point—and, as we shall presently see, a point also of considerable interest—about the Rgvedic *ṛta* is its relation to the Vedic gods as conceived by the ancient poets. *Ṛta*—the primordial complex of natural law and social law—has *nothing to do with the will of God* or that of any Vedic deity: the deities are at best the custodians of the *ṛta*, but they have nothing to do with the making of it or bringing it into being by their will. Here are some of the passages from the *Rgveda* in rough English rendering illustrating the point:

‘O Agni, your brilliance comes to us and you brought the cows of *ṛta* equally to us (*ṛtasya dhenah anayanta sa-srutah*: Sayana interpreted *sa-srutah* as *samanam gacchantyah*) (i. 141. 1).’ ‘O Mitra and Varuna, you bring *ṛta* for the *yajamānas* and let the *yajna* be bountiful (i. 151.3). ‘As of old, O Indra, you remain the custodian of food and the custodian of the *ṛta*; you help us in searching our cows and be friends with us (i. 132.3). ‘O Mitra and Varuna, O Asuras—the possessors of *ṛta*—you proclaim loudly of *ṛta*, since you two are great experts of heaven; do connect us with cow and water.’ (i. 151.4) ‘You two (Mitra and Varuna), possessors of *ṛta* are the foremost suppliers of cows in the *yajna*...’ (i. 151.8). ‘He who gives to the bright followers of the *ṛta*, and whom the Adityas increasing,—he, as the foremost, goes with wealth in a chariot to distribute wealth in the assemblies.’ (ii. 27.12) ‘The great Agni increased without any restraint in the expanse

with water and food in the past ; it lay down in the source of *rta* (*rtasya yonau*), being of a charitable disposition and being friends with the water.' (iii. 1.11) 'Agni, the custodian of the *rta* and the possessor of the *rta*, is, like Bhaga, the leader of men.' (iii. 20.4) 'O Visvadevas, he who bears the *rta*—him, the seniormost, do you procure large number of cows.' (iii. 56.2). 'Usas, like the Dyavaprthivi (heaven-and-earth), the custodian of the *rta* and of wealth.' (iii. 61.6) 'O Dyavaprthivi, let your *rta* prevail that we may get wealth along with food. (iii. 54.3) 'As our fathers, (Angirasas), in the past, spread the *rta* so did they discover the tawny cows.' (iv. 2.16) 'From the ancient days, the *rta* has got many waters and much wisdom which discards the undersirables ; the verses of the *rta* opened the deaf ears of men.' (iv. 23.8) 'The holdings of the *rta* are fast. the manifold forms of the *rta* are delightful, the praisers desire abundant food of the *rta*, by virtue of the *rta* cows are obtained and they (the cows) enter into the *rta*.' (iv. 23.9) Having pleased the *rta* the praisers gain strength and water ; the earth does yield the best cows only for the sake of the *rta* and it is vast and incommensurable because of the *rta*.' (iv. 23.10) 'In the ancient days, Usas-es were truths born of the *rta*, who gave wealth as soon as approached and, praising whom with *uktha* ready wealth was obtained.' (iv. 51.7). 'Usas-es, the deity who knew the abode of the *rta*, made the cows.' (iv. 51.8). 'Usas, the friend of the Asvins, was the mother of cows and the protector of the *rta*.' (iv. 52.2) 'Desirous of the *rta*, the ancients, in the past, praised you, O Agni, for their protection—you, Agni the Angiras, who are great delighter of the mortal, the giver of food (and the lord of the dwelling)'. (v. 8.1). 'O Mitra and Varuna, who, wishing for the *rta*, can get you? Protect us in the abode of the *rta* ; give animals and food to those who desire *yajna*.' (v. 41.1) 'You (Varuna and others) are the custodians of the *rta*, born of the *rta*, increasers of the *rta*, the terrible enemies of *anrta* (the opposite of *rta*) ; thus may we and other heroes remain with happiness and wealth in your abode' (vii. 66.13). And many more like these.

A superficial understanding of the exaggerated epithets used by the poets for their gods may mislead us into imagining that the gods were conceived as determining the course of nature. But the point is that the gods as gods were not doing

it. On the contrary, they could do this only in the capacity of observers or guardians, or upholders, of the *ṛta*. The gods were even thought of as owing their very existence to the *ṛta*, for it was often said that they were born of the *ṛta* itself. All these are to be understood along with the fact that human beings, too, were similarly conceived by the Vedic poets; the ancient Angirasas, as we have already seen, sat in the joyful company of the gods, and this, as observers of the *ṛta*.

Of all the Vedic gods, Mitra and Varuna—particularly the latter—were most often mentioned as the gods who determined the course of nature :³⁷

Varuna's power is so great that neither the birds as they fly nor the rivers as they flow, can reach the limit of his dominion, his might, and his wrath (i. 24. 6).... He embraces the all and the abodes of all beings (viii. 41.1 & 7)..... Varuna is omniscient. He knows the flight of birds in the sky, the path of ships in the ocean, the course of the far-travelling wind, and beholds all the secret things that have been or shall be done (i. 25. 7; 9 & 11);No creature can even wink without him (ii. 28. 6). The winkings of men's eyes are all numbered by Varuna, and whatever man does, thinks, or devises, Varuna knows (AV iv. 16. 2; 5).

All these are true. Still the question is: To what did Varuna owe all this stupendous power? The Vedic poets left us with no uncertainty as to the answer. They were never tired of telling us that of all the Vedic gods Varuna (often, of course, along with Mitra) had the closest connection with the *ṛta*. Varuna, along with Mitra, was the guardian of the *ṛta*—*ṛtasya gopa*—and only in this capacity were they the rulers of the rivers and the bestowers of food and rain.³⁸ They were the revealers of the *ṛta* and the increasers (or upholders) of the *ṛta*, but all these, significantly enough, were accomplished by the aid of the *ṛta*.³⁹

"O Mitra and Varuna, you touch the *ṛta* and increase the *ṛta* with the aid of the *ṛta* and spread yourselves for the purpose of increasing the *yajna*."⁴⁰ Mitra and Varuna were seen

37. A.A. Macdonell VM 26

38. RV vii 64.2

39. *Ibid* i. 23.5.

40. *Ibid* i. 2. 8

in the place of the *rta* covered by the *rta*.⁴¹ The epithet "observer of order" (*rtavan*), predominantly used of Agni, is also several times connected with Varuna and Mitra.⁴²

Now if this was the nature of the relation of the *rta* with Mitra and Varuna, what reason have we to assume that the *rta* was dependent upon the gods, or that it was the expression of the will of the gods? There is none and even Keith had to admit this, though partially :⁴³

The streams go on their way according to the *rta* of Varuna, heaven and earth further the *rta* of Mitra, and the two gods appear as the lords of the *rta* the right. Yet on the other hand they are reduced to a lesser grade in that they appear also as the charioteers of the *rta*, the furtherers of the *rta*, the guardians of the *rta*, something which therefore exists apart from them.

The epithet for 'upholding the *rta* by the aid of the *rta*' though mostly applied to Mitra and Varuna, was also applied to the Adityas and to the gods in general.⁴⁴ The Adityas, as also Agni and Soma were looked upon as the guardians of the *rta*.⁴⁵ The gods were often described as being born of the *rta* : Soma, the king and god, was born of the *rta* and increased manifold the *rta* with *rta* (*rtena yah rta-jatah vivavrdhe raja devah rtam brhat*).⁴⁶ No wonder, therefore, that Soma was identified with the *rta* itself.⁴⁷ Agni was born of the *rta* and hence was shining (for the poet).⁴⁸ This birth of Agni from the *rta* had interestingly also a reference to the hoary antiquity : a *rk* of the oldest stratum of the *Rgveda* referred to him as *rta-jatah purvih*.⁴⁹ Asvins, too, were born of the *rta*.⁵⁰ Being born of the *rta*, the *gana* (i.e. the tribal collective) of the Maruts was without blemish.⁵¹ The gods themselves behaved according to the *rta* : Soma, shining with the *rta*, spea-

41. *Ibid* v. 62.1

42. Macdonell VM 26

43. A.B. Keith RPVU 84

44. Macdonell VM 26

45. *Ibid*

46. *RV* ix. 108.8

47. *Ibid* ix. 62.30

48. *Ibid* i. 36.19

49. *Ibid* iii. 20.2

50. *Ibid* iii. 58.8.

51. *Ibid*, v. 61.14

king the *ṛta*, was purified and flowed towards Indra.⁵² The Visva-devas (all-gods) were upholding the *ṛta* (*ṛta-dhitayah*).⁵³ It was because of the *ṛta* that Agni obtained his immortality.⁵⁴ More examples are not necessary. Evidently the principle of the *ṛta* was to the Vedic poets much more fundamental than any hypothetical will of the Vedic gods.

Lest we are misled to view the *ṛta* as the will of the gods, it is worth remembering further that the *ṛta* was not connected with the gods alone. Even the cows, while lowing the *ṛta* obtained the technique of the *ṛta*.⁵⁵ Sarama, the dog, recovered the cows, with the aid of the *ṛta*,⁵⁶ just as the all-gods (Visva-devas) obtained the cows by increasing the *ṛta*.⁵⁷

In the understanding of the Vedic poets, the *ṛta* is thus an independent principle operating—or desired to operate—by its own inner dynamism, and the Vedic gods are themselves supposed to observe it or act according to it, though in some poems the gods are also described as being the “custodians” of the *ṛta* or the “protector” of the *ṛta*. But nowhere in the *Rgveda* is there any suggestion of this primordial concept embodying the potentials of what the later scientists call laws of nature yielding to the will of God or of the gods.

The point is exceedingly interesting and to see its special interest we begin with two observations of Needham.⁵⁸

For without doubt one of the oldest notions of Western civilisation was that just as earthly imperial lawgivers enacted codes of positive law, to be obeyed by men, so also the celestial and supreme rational creator deity had laid down a series of laws which must be obeyed by minerals, crystals, plants, animals and the stars in their courses. Unfortunately, if one turns to the best books and monographs on the history of science, asking the simple question, when in European or Islamic history was the first use of the term ‘laws of Nature’ in the scientific sense, it is extremely hard to find an answer. By the 18th century it was of course current coin—

52. *Ibid* ix. 113.4.

53. *Ibid* v. 51.2.

54. *Ibid* i. 68.4.

55. *Ibid* x. 61.10.

56. *Ibid* v. 45.7.

57. *Ibid* iii. 56.2.

58. J. Needham. SCC II. 518.

most Europeans are acquainted with these Newtonian words of 1796 :

Praise the Lord, for he hath spoken.
 Worlds his mighty voice obeyed ;
 Laws, which never shall be broken.
 For their guidance he hath made.

Here evidently the conception of the laws of nature follows from the monotheistic conception, the roots of which in European thought are ultimately traceable to the Hebrew view. As Needham observes :⁵⁹

Far more certain as another contributory line of thought was that which emanated from (or was transmitted from the Babylonians by) the Hebrews. The idea of a body of laws laid down by a transcendent God and covering the actions both of man and the rest of Nature is frequently met with, as Singer and many others have pointed out. Indeed, the divine lawgiver was one of the most central themes of Israel. It would be difficult to overestimate the effect of these Hebrew ideas on all occidental thinking of the Christian era—'The Lord gave his decree to the sea, that the waters should not pass his commandment' (*Psalms* 104)—'He hath made them fast for ever and ever ; he hath given them a law which shall not be broken' (*Psalms* 148). Furthermore, the Jews developed a kind of natural law applying to all men as such, somewhat analogous to the *jus gentium* of Roman law, in the 'Seven Commandments for the Descendants of Noah' (*Isaacs*, I). This was liable to conflict with Talmudic law (*Teicher*, I).

How the conception of the laws of nature as understood in modern science got eventually disentangled from monotheistic theology is an exceedingly important question, and, as we shall see, it is relevant also for understanding the history of science in ancient India. Before passing on to all this, let us try to have a fuller idea of the conception of *ṛta* in the *Rgveda*.

The first point to be noted in this connection is that the conception of *ṛta*—though containing in embryo the idea of the laws of nature—could never have occurred to the Rgvedic poets as ordained by any omnipotent Divine Creator for the simple reason that the monotheistic theology was totally unknown to them. Whether, among some later Indian philosophers there was a move towards monotheism is, of course, besides the point, for we are discussing here the understanding

59. *Ibid* II. 536.

of the Rgvedic seers or poets and not the later philosophers ostensibly pledging allegiance to *Rgveda*. However, from the passages already quoted from the *Rgveda* it is obvious that specially in the verses in which the concept of the *rta* occurs there is not even any hint of monotheism and there is no hint whatsoever of this concept suggesting the primordial complex of natural order and social order having anything to do with the will of any omnipotent creator.

What, then, could possibly be the source of the concept of the *rta*? Since it represents a pre-monotheistic stage of thought, one way of seeking for its roots is to begin with the genesis of it as an aspect of the monotheistic conception itself. Following Henry Maine's *Ancient Laws*, Needham sums it up :⁶⁰

Scholars unversed in the history of jurisprudence turn naturally to the well-known book of Maine. He first explains that the earliest law was the case-law of unwritten custom in primitive societies. Their usages were not commands and there was little sanction save the moral disapproval of the society if they were transgressed, but gradually a body of judgements grew up after the differentiation of society into classes : the 'dooms' of Teutonic, or the themistes of Homeric, chieftains. With the growth of State power these judgements could more and more afford to overstep the bounds of the precepts which the society had formerly followed, and continued to follow, as being, for it, demonstrably based on universally acceptable ethical principles. And thus the will of the lawgiver could embody in codes of enacted statutes, not only laws which had as their basis the immemorial customs of the folk, but also laws which seemed good to him for the greater welfare of the State (or the greater power of the governing class) and which might have no basis in *mores* or ethics. This 'positive' law partook of the nature of the commands of an earthly ruler, obedience was an obligation, and precisely specified sanctions followed transgression.

To this may be added another point. Needham substantially agreeing with Edgar Zilsel in viewing the history of human law and the laws of nature⁶¹ notes that among the ancient Greek thinkers the Stoics maintained that "Zeus (immanent in the world) was nothing else but *koinos nomos*, Universal Law"⁶² and adds : "Zilsel, alert for concomitant social phe-

60. *Ibid* II. 519.

61. *Ibid* II. 533, note a.

62. *Ibid* II. 534.

nomena, notes that just as the original Babylonian conceptions of laws of Nature had arisen in a highly centralised oriental monarchy, so in the time of the Stoics, a period of rising monarchies, it would have been natural to view the universe as a great empire, ruled by a Divine Logos."⁶³

With these points in mind we may return to our conception of the *ṛta* in the *Rgveda*. If the laws of nature, as originally understood, were viewed abroad as connected with the idea of the will of one Supreme God, i.e. as a corollary of monotheism, monotheism itself had its own history and was but an extension in the ideological sphere of the idea of a Supreme Ruler of the State, benevolent or otherwise. Such an idea of God could not and did not emerge among the Rgvedic poets, from whose consciousness was not washed out the memory of the tribal collectivity—the memory of property being collectively owned and shared out among the tribesmen (*bhaga* and *amsa*) and of society being ruled by the tribal assemblies (*sabha* and *samiti*).

What, then, could be the source of the conception of the *ṛta*?

Thomson⁶⁴ has argued that "man's consciousness of the external world was determined from the outset, not by the relations between the individual and his natural environment, but by the relations which he had established with his fellows in the development of production... Only in this way is it possible to explain why the external world should appear so differently to peoples standing at different levels of culture... Such developments only become intelligible when we understand that man's consciousness of the world around him is a social image, a product of society."

Proceeding on the basis of this we may, in accordance with our method, ask ourselves: what is known in general about the moral consciousness of the backward peoples surviving in the truly tribal societies, which, as tribal societies, must be basically similar to that of the early Vedic poets?

The following passages are from Engels:

63. *Ibid.*

64. G. Thomson SAGS II. 45-46.

The grandeur and at the same time the limitation of the gentile order was that it found no place for rulers and ruled. In the realm of the internal, there was as yet no distinction between rights and duties; the question of whether participation in public affairs, blood revenge or atonement for injuries was a right or a duty never confronted the (Iroquois) Indian; it would have appeared as absurd to him as the question of whether eating, sleeping or hunting was a right or a duty.⁶⁵

The tribe, the gens and their institutions were sacred and inviolable, a superior power, instituted by nature, to which the individual remained absolutely subject in feeling, thought and deed. Impressive as the people of this epoch may appear to us, they differ in no way one from another, they are still bound, as Marx says, to the umbilical cord of the primordial community. The power of these primordial communities had to be broken, and it was broken. But it was broken by influences which from the outset appear to us as a degradation, a fall from the *simple moral grandeur of the ancient gentile society*. The lowest interests—base greed, brutal sensuality, sordid avarice, selfish plunder of common possession—usher in the new civilized society, class society....⁶⁶

The Vedic *ṛta*, in its aspect of the human relations, could have originally been what Engels called here the 'simple moral grandeur of the ancient gentile society': the laws regulating the relations of the members of the pre-class society were instinctively apprehended by them as sacred and inviolable, a superior power instituted by nature to which the individual remained absolutely subject in feeling, thought and deed. And if this was so, their consciousness of the external world, being a social image, could only be an extension or projection of the same. This could give the early Vedic poets their conception of the *ṛta*—an archaic complex of the physical and moral law, so sacred and inviolable that even the greatest gods were born of it.

That this was presumably so can perhaps be seen from the internal evidences of the Vedic literature itself. Most of the modern scholars discussing the world-outlook of the ancient Vedic poets have discussed the glory of the *ṛta* in the *Rgveda*. What needs to be added to it—and what is not generally discussed by the Vedic scholars—is the *sense of the loss of an-*

65. F. Engels OF 258.

66. *Ibid* 163; emphasis added.

cient rta in the Vedic literature itself, evidently reflecting the later conditions.

To begin with, it needs to be remembered that the *Rgveda* as a vast collection of songs and hymns, was composed over many centuries. The internal chronology of the *Rgveda*, therefore, still continues to be a question of considerable controversy. What seems to be beyond controversy, however, is the assumption that throughout the vast period of the composition of the *Rgveda*, the Vedic society could not be a stationary one. The ancient collective life of the Vedic tribesmen—the relics and memory of which so abound in the *Rgveda*—could not and was not a permanent feature of the Vedic society. In short, the tribal collectivity had to disintegrate, making room for a class divided society. Here is how Engels describes this process of disintegration, depending mainly on the evidences about the Indo-European peoples available in his times :⁶⁷

The military commander of the people—*rex*, *basileus*, *thiudans*—became an indispensable and permanent official. The popular assembly was instituted wherever it did not yet exist. The military commander, the council and the popular assembly formed the organs of the military democracy into which gentile society had developed. A military democracy—because war and organisation for war were now regular functions of the life of the people. The wealth of their neighbours excited the greed of the peoples who began to regard the acquisition of wealth as one of the main purposes in life. They were barbarians : plunder appeared to them easier and even more honourable than productive work. War, once waged simply to avenge aggression or as a means of enlarging territory that had become inadequate, was now waged for the sake of plunder alone, and became a regular profession... Internal affairs underwent a similar change. The robber wars increased the power of the supreme military commander as well as of the sub-commanders. The customary election of successors from one family... was gradually transformed into hereditary succession, first tolerated, then claimed and finally usurped. The foundation of hereditary royalty and hereditary nobility was laid. In this manner the organs of the gentile constitution were gradually torn from their roots in the people, in gens, phratry and tribe and the whole gentile order was transformed into its opposite : from an organisation of tribes for the free administration of their own affairs it became an organisation for plundering and oppressing their neighbours ; and correspondingly, its organs were transformed from ins-

67. F. Engels OF 267-9.

truments of the will of the people into independent organs for ruling and oppressing their own people. This could not have happened had not the greed for wealth divided the members of the gentes into rich and poor; had not 'property' differences in a gens changed the community of interest into antagonism between members of a gens' (Marx); and had not the growth of slavery already begun to brand working for a living as slavish and more ignominious than engaging in plunder.

What do we read in the *Rgveda* as the repercussion of this change? One aspect of it is already noted by Roth and Whitney:⁶⁸ the ancient glory of Varuna, the custodian of *ṛta par excellence*, was lost; he had to move to the background to make room for the supremacy of Indra, the war-god of the *Rgveda*. This is mythology no doubt. What specially interests us, nevertheless, is the sense of the loss of *ṛta* along with the degradation of Varuna. As Kutsa, whose songs we read in the admittedly latest portion of the *Rgveda* (namely the first *mandala*), cursed the new development with the sense of *ṛta* lost:

I ask thee, O *yajna*, the ancient one (*avama*: Sayana took this to refer to Agni, the first of the gods)! Let his (i.e. *yajna*'s) messenger speak with due consideration: Where is the *ṛta* of the past gone? Who is the new one (*nutana*) that holds it? Know this of me, O Heaven-and-Earth (i. 105.5).

[Sayana's commentary on the word *nutana* is worth mentioning: 'if there were such a (new) one, the present condition of mine would not have been; hence there is none such.' No less interesting is the challenging tone of the *rk*, a tone that runs through the other verses attributed to the same poet:]

All these gods, who are in the three spheres, where is the *ṛta* of yours gone? Where, again, the absence of the *ṛta*? Where, as of old, are the *yajna* (*ahuti*) of ours? Know this of me, O Heaven-and-Earth (i. 105.5).

Where, O gods, is the holding of the *ṛta*, where is the watchfulness of Varuna? Where, again, is the path of the great ways of Aryanian? And hence are we fallen in misery. Know this of me, O Heaven-and-Earth (i. 105.6).

We ask of Varuna, the knower of the path and the maker of food.—I utter this from my heart, let the *ṛta* be born anew (*navyah jayataṃ ṛtam*). Know this of me, O Heaven-and-Earth (i. 105.15).

Keith observed, "the idea of *ṛta* is one which, like the moral elevation of Varuna, has no future history in India."⁶⁹ Per-

haps another way of putting it is that the ancient collective life with its "simple moral grandeur of the ancient gentile society" had no future in the history of India until recent times when the demand for it is reiterated though at an incomparably higher level.

It is no use speculating what would have happened in India had the Vedic pantheon of innumerable gods (and a few goddesses) developed into something like Christian monotheism? European parallels tempt us to think that the ancient concept of the *ṛta* would, in that event, have made room for something like the will of God imparting laws to nature. But the fact is that this did not take place. The sense of *ṛta* withered away from the Vedic consciousness, leaving the Upanisads only desultorily to mention the old word without its ancient grandeur. In the subsequent history of Indian thought, it was replaced in two ways. In the theologico-political circle, it made room for the law of *karma* and in the circle of scientist-materialists—often branded as abject heretics—it assumed the concept of *svabhava* which, though literally meaning "nature" perhaps carried the connotation of the "Laws of nature". But more of this later.

It is not the place for us to discuss how, in the history of European thought, the concept of the law of nature, originally understood as the will of God, gradually got disentangled from its theological association and assumed the secular form of natural science. Zilsel has already discussed it with whom Needham substantially agrees. Readers interested in the question would profitably go in for their writings. What concerns our immediate discussion is another point. Did the Vedic people contribute to the general fund of the scientific achievements of ancient India in any other important sense than the proto-scientific idea of natural law which they called the *ṛta* and which in the science circle anticipated the concept of *svabhava*?

7. WRONG WAY OF READING SCIENCE IN THE VEDAS

There are various attempts to read in the Vedas science or the potentials thereof. But there seems to be a wrong way as well as a right way of doing this.

The examples of the wrong way of reading science in the Vedas are indeed numerous. Such an attempt is perhaps also understood specially during the period of the struggle for our national independence. An unarmed people fighting colonial forces had somehow to boost up its morale by trying to overrate the achievements of our ancient *rsi*-s. The motivation of inflating the scientific achievements of the Vedic peoples, in other words, was to show that howsoever strong might have been the brute force of the colonisers, it must not be forgotten when their ancestors were at best but barbarians, our sages could intuitively attain knowledge in certain forms which took many many centuries for the Europeans to reach in the form of natural sciences.

With the achievement of our political independence, however, this way of boosting up the morale of the Indian people has lost its relevance. Since 1947, India has been trying to take steps to develop into a modern nation, and hence the need is felt for developing in India modern science and technology in their right sense. At the same time there remains the need of highlighting the importance of our national heritage—of reminding ourselves of the true glory of our past, so that the hangover of the old colonial mentality of at least a section of our people is fully overcome. But this must not be done in a wrong and perverted manner, one form of which is to claim that everything worthwhile in modern science was already achieved by the ancient sages of the Vedas.

Unfortunately such a tendency to overrate the scientific achievements of the Vedic people still persists in the country. We have already seen in our *Introduction* how a modern Indian scientist as eminent as M. N. Saha had to struggle against it. This, as he has argued, is a totally perverse way of glorifying our ancient culture, besides being a factor inhibiting the real development of modern science in India. In spite of all that Saha and the rightminded people like him did, the tendency continues in our country, which, to say the least, is unfortunate. It will perhaps require a separate book or booklet for a full-length survey of it as still persisting, though one expects that it should decline with the objective understanding of the Vedas.

In such circumstance, however, it proved specially annoying to see also in some of the “spiritual” leaders the zeal to

overrate almost to a fantastic extent the science-contents of the Vedas. This has started creating considerable confusion among a section of our people without proper acquaintance either with Vedas or with modern science. A certain "great sage" or Maharshi known as Mahesh Yogi has started what he calls "Vedic University", with its main administrative centre somewhere in Switzerland. As advertised in a really big way in some leading Indian newspapers as well as scientific journals abroad, this university is "undertaking research study in the relationship of the *Rig Veda* to the latest discovery of modern physical and biological sciences." Recently, in 1985, the said "University" held "First European Conference on Vedic Science". I have before me copies of its proceedings. These open with the message of Mahesh Yogi the founder of the university 'via conference telephone from South American Continental Capital of the Age of Enlightenment, in Brasilia, Brazil': "With the discovery of the unified field by modern science, we feel inspired to offer to the world the complete knowledge of the organizing power of nature. This is going to provide a new status to life on earth, giving rise to a unified field based perfect civilization."

The theory of Unified Field of modern science being outside the scope of my own specialisation, I passed on the Report of the Conference for its assessment to Partha Ghose, who has substantial reputation among our physicists. Following is the reply I received from him :

8th September, 1985

Dear Professor Chattopadhyay,

I was amazed and concerned to read Newsreport No. 1 of the Maharishi Vedic University which you gave me to read and comment on... The essence of the scientific method lies in the hard renunciation of the all too tempting desire to grasp the "ultimate truth" immediately and subjectively in a holistic flash of "revelation" or "enlightenment". In Einstein's words the road to the paradise of science is "not as comfortable and alluring as the road to the religious paradise" [A. Einstein in "Autobiographical Notes" in *Albert Einstein: Philosopher-scientist* ed. by P. A. Schilpp, Harper & Row], but it is more 'trustworthy'. There is no giving up of logic at any stage, however arduous the path might be, although logic itself keeps developing as new phenomena are discovered that do not

fit the old concepts. In this way one gradually attains a surer, more and more unifying and deeper mental grasp of things. And what is more, such knowledge is communicable in mathematical language, publicly available and applicable.

The Vedas, on the other hand, are assumed by the Maharishi and his followers to contain a holistic, subjective knowledge of the absolute truth which is extra-logical. To talk of "Vedic science" and "holistic science" is therefore a contradiction in terms as far as the word goes.

The modern unified field theories of physics are very firmly rooted in the traditional scientific method, and in no way reflects the kind of "three in one" structure of the "Maharishi Technology of the Unified Field" (whatever that might be). From what I could glean there is some vague resemblance of the latter with the measurement problem in quantum mechanics of the late 1920's. But even there the subjective interpretation is by no means accepted universally. In fact, the majority of physicists hold to an objective interpretation, and surely nowhere is the subjective interpretation ever used in practice.

This kind of hasty identification, I find, usually stems from a lack of genuine interest and understanding of modern physics, and is not only pointless and superficial but misleading, particularly when it is made by a person like the Maharishi who is held in great esteem by a large number of devotees all over the world who are unable to evaluate the true worth of his statements and accept them uncritically.

The tendency to glorify the Vedas by trying to give them a garb of scientific respectability is pathetic. It only reveals a basic lack of respect for them and a failure to appreciate their true worth which, I think, lies in their exquisite poetry and occasional flashes of philosophical wisdom. Taking into account the age in which they were conceived and written, I find them extraordinarily rich. However, it is difficult to believe they contain the whole of science.

If they do and if the Maharshi claims to know it all, why is he making us poor mortals spend so much money and effort in rediscovering it?...

I was amazed to read Dr. Geoffrey Clements' alleged statement that the "benefits of the Maharshi Technology of the Unified Field have already been validated by more than 300 scientific studies in all areas of physiology, psychology, sociology, and ecology, conducted at over 150 universities and research institutes on all continents." Anybody who makes such a sweeping statement without first facing professional scientific bodies and without giving references to authentic publications in respectable professional journals, only deserves to be ignored.

Two comments will be in order here. First, it was Einstein who first emphasised the need for a unified field theory. In this time he was thinking in terms of unifying electromagnetism and gravitation. He spent the last 30 years of his life trying to achieve this unification,

but he failed; the problem remains unsolved even today. On the other hand, electromagnetism and the weak nuclear force (responsible for radio-activity) have been satisfactorily unified into a single electro-weak theory by Salam, Weinberg and Glashow (1967/68). Some interesting theories (called Grand Unified Theories or GUTS) of unifying this electro-weak force with the strong nuclear force have also been proposed, but there is as yet no conclusive experimental evidence in support of such a theory. Physicists have nevertheless gone ahead and proposed a unification of all the four fundamental interactions including gravity by using the idea of supersymmetry (the symmetry between fermions and bosons) and strings (in which the basic objects are string-like). But these are still in a very embryonic stage. To conceive of a grand idea of unification is one thing and a very creditable thing; to give it a concrete shape is quite another. If and when physicists finally succeed in constructing a satisfactory unification of all the fundamental forces, will it make sense to say that Einstein knew it all?

Secondly, these modern unified field theories only deal with the purely physical world: they have nothing whatsoever to say about physiology, psychology, sociology or ecology. Science is far, far away from anything resembling a unified theory of all its branches...

I hope the above comments will be of some use in clarifying the true position of modern physics.

With kind regards and best wishes,

Yours sincerely,
Partha Ghose

But let us leave the question of the so called "Vedic University" and turn to another recently published book which has created considerable sensation in recent time. It is called *Vedic Mathematics or 'Sixteen Simple Mathematical Formulae from the Vedas'* (For one-line Answers to all Mathematical Problems) by Jagatguru Swami Sri Bharati Krishna Tirtha Maharaja Shankaracharya of Govardhana Matha, Puri, originally published by the Benaras Hindu University in 1965, and, as reprinted in an inexpensive edition, is having very wide circulation these days.

The special difficulty created by the book is that its author is far from being an amateur as far as mathematics (specially arithmetic) is concerned. The book is full of highly clever algorithms, often showing amazingly simple ways of arithmetical calculations. This makes it impossible to brush off the intrinsic importance of book. What nevertheless is extremely deceptive about it is its title and major historical claim. The

title wants us to believe that the algorithms are actually contained in the Vedas (or auxiliary Vedic works). To create such a make-belief, the author gives sixteen formulas in Sanskrit, on which all his calculations are said to be based, adding that all these are from the Vedas. But it has proved impossible to trace these formulas to the Vedas. In short, notwithstanding the mathematical excellence of the book, its title has no more worth than that of a fiction. It is thus another recent example for us of the wrong way of reading science in the Vedas.⁷⁰

70. Reviewing the book in *IJHS* Vol. iii. No. 1, May 1968 (pages 59-60), A. K. Bag states: "The author admits that these sutra-s and corollaries have been derived from the *Atharvaveda*, till now no scholar has been able to trace this relationship." In the same journal (vol. xviii, No. 2, p. 223), R. C. Gupta observes: "from the language of the 16 *sutra*-s (formulae), it is clear that they are author's own composition in modern Sanskrit but employing the old *sutra*-style. Hence author's claim that they are 'contained in the *Parisista* (the Appendix-portion) of the *Atharvaveda*, (p. xv) can be justified only by regarding them, following a suggestion by V. S. Agrawala (see p. 6 of his *Foreword*), as a new *Parisista* added according to the tradition of formulating subsidiary apocryphal texts. It seems that the author attached the name of Vedas to his work in retaliation to one of his teacher's habit of refuting the opinion that even formula of modern mathematics are contained in the Vedas (see *Bulletin of the National Institute of Sciences of India*, No. 21, 1963, p. 253). In his *Preface* (pp. xiii-xxx), the author talks of 'The Astounding Wonders of Ancient Vedic Mathematics' and says that 'the Vedas should contain within themselves all the knowledge needed by mankind.' (p. xiii)". However, as an earlier reviewer (T. S. Kuppanna Sastri in *VJ* vol. 4 pt. i, pp. 108-9) rightly observes: "One would expect from the title *Vedic Mathematics* that the contents are to be found in what are accepted as the Vedas, or in the *Parisista*-s belonging thereto intended for the elucidation of the Vedic rituals. But the work is not Vedic in this generally accepted sense, neither the so-called *sutra*-s nor the contents being found anywhere in the Vedic literature. Therefore, we can take it, with the General Editor (*Intro.* pp. 6-7), that the contents are not what are in the Vedas but what *should be* there on account of the Vedas being the source of knowledge, if only the author had not described the work, in his *Preface* (p. xiii), to be 'on the astounding wonders of ancient Indian Vedic mathematics', and incen-

8. RIGHT WAY OF READING SCIENCE IN THE VEDAS

We have mentioned examples of trying to over-rate science and science-potentials in the Veda not because it is typical of the modern scholars but because a considerable number of our scholars are not altogether free from this basic tendency.

As already observed, for the pioneers of Indian studies in modern times, the Vedas remained virtually the only starting point as sources for Indian history and hence they were under the peculiar obligation to seek the roots of all science and technology in the Vedas. With the discovery of the Indus Valley Civilization such an obligation has ceased to exist, yet the tendency to read the beginnings of technology and science in the Vedas continues at least among many scholars. There seems to be also a simple method to follow for the purpose. It is, in short, to consult the *Vedic Index of Names and Subjects* by Macdonell and Keith. Admitting the extraordinarily remarkable scholarship that has gone to its making, it may as well be remembered here that the work was first published in 1912, when research in what are called the loan words—particularly words of the local people entering into the Vedic vocabulary—was at best in its infancy. Secondly, the work is based on the survey of a vast literature beginning with the *Rgveda* and stretching upto the Upanisads—the latter foreshadowing the period of the second urbanisation, when the Vedic people lose much of their original identity, being largely mixed up with the local people and adopt much of their material culture. The older method is thus no longer tenable.

We have already had some objective idea of the material culture of the Rgvedic people, so a good deal of caution is necessary before reading in the *Rgveda* much of advanced technology and science. Unfortunately such caution is not always maintained and we frequently come across exaggerated acco-

santly throughout the work, tried to create the impression that what he gives are from the Vedas themselves. His effort at glorifying the Vedas and Hindu culture by these false claims will only create a revulsion of feeling when the truth is known. The pity is that what the author gives is not even Hindu classical mathematics."

unts of the technological and scientific achievements of the Rgvedic peoples.

What appears to be more unfortunate is that behind the anxiety to impute to the Vedic peoples undue achievements, what was really something of the nature of extra-ordinary importance about them from the viewpoint of the history of science is often obscured or ignored. The very composition of the *Rgveda*—embodying as it does 1,028 songs or hymns by pre-literate pastoral peoples—is itself a wonder of wonders. No less a wonder is the preservation of it by sheer retentive memory. The literary merit of this vast literature is discussed by others and falls outside the scope of our discussion. What is within the scope of our discussion—and without which no history of science in India can be adequate—is the technique developed for its preservation in memory, with meticulous care for rightly pronouncing each syllable in the vast literature, the understanding of the metre in which each hymn is composed, the grammatical syntax of their composition, their exact meaning, and so on, though not without internal controversies among later thinkers who got absorbed in such problems. Understandably, all this formed the starting point of a number of formal sciences, like phonetics, metrics, linguistics, etc.

Fortunately, I found my young colleague Navjyoti Singh of NISTADS, New Delhi, has for some years been working on this theme. What is all the more fortunate for me is that he has conceded to my request to contribute a chapter on this positive aspect of science and science-potentials in the Vedic tradition. With grateful thanks to him, I am using his contribution as the next chapter of the present study.